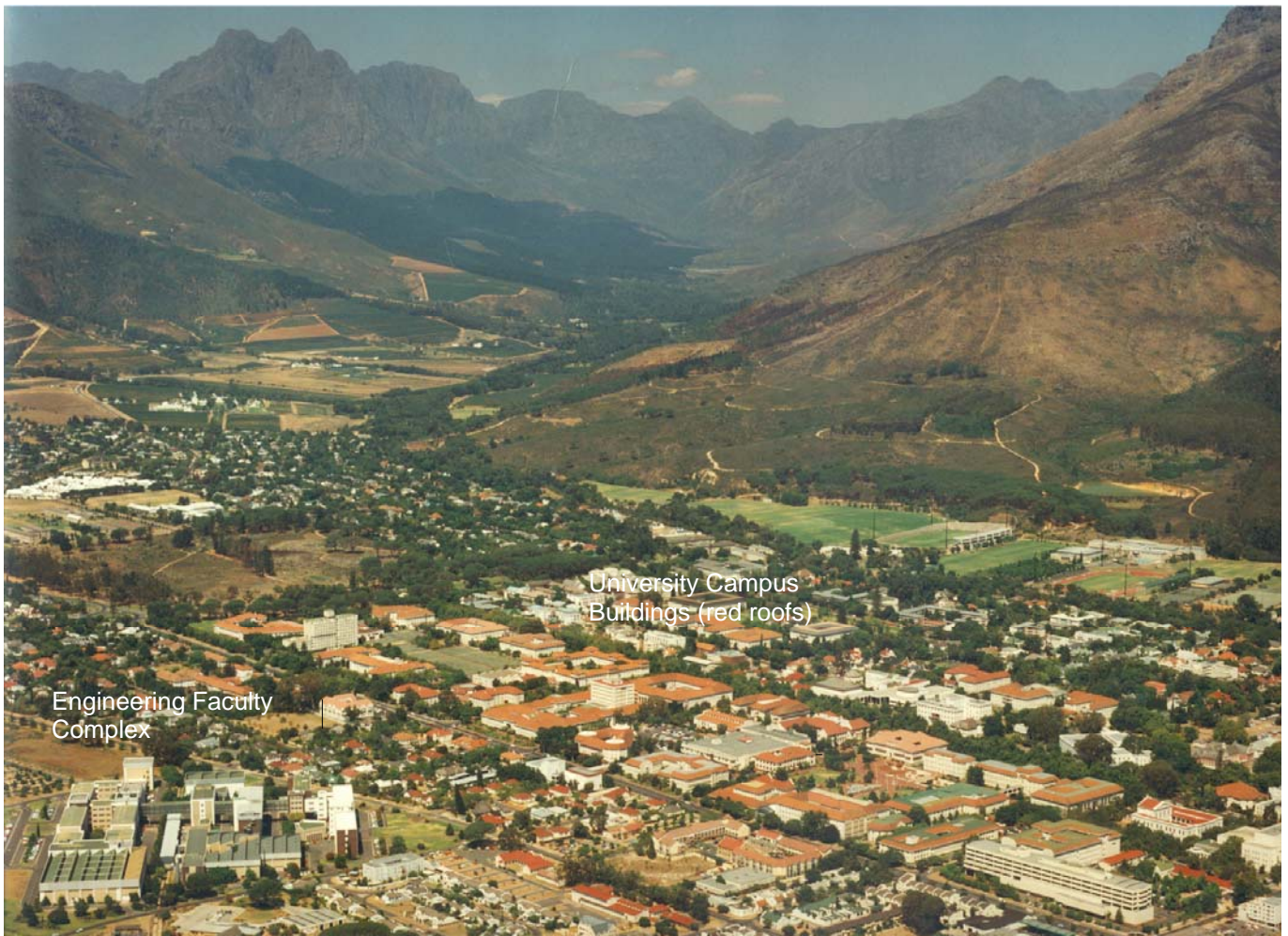




**University of Stellenbosch**  
Faculty of Engineering  
Department of Civil Engineering  
Institute for Water and Environmental Engineering  
South Africa



## **INFORMATION ON CAPACITY OF THE INSTITUTE FOR WATER AND ENVIRONMENTAL ENGINEERING (IWE)**



### **Faculty of Engineering Academic Departments:**

- **Civil Engineering** [www.civeng.sun.ac.za](http://www.civeng.sun.ac.za)
- **Electrical and Electrical Engineering**
- **Mechanical Engineering**
- **Process (Chemical) Engineering**
- **Industrial Engineering**
- **Applied Mathematics**



**Department of Civil Engineering Divisions:**

- Water Engineering
- Geotechnical and Transport Engineering
- Structural Engineering

**Department of Civil Engineering Institute:**

- Institute for Water and Environmental Engineering (IWE)
- Director: Prof GR Basson [grbasson@sun.ac.za](mailto:grbasson@sun.ac.za)

## A) Introduction

IWE fields of specialization include water resources development, environmental water requirements, river hydraulics, hydraulic structures, river and reservoir sedimentation, hydrology, coastal engineering and water services.





IWE is endowed with an excellent and spacious hydraulic laboratory where under graduate and post graduate education and research is undertaken and where a large number of model studies of real case prototype projects have been performed. Computer modeling also finds wide application in research and specialist consulting work.

## **B) Hydraulics Laboratory Facilities**

The Division of Water Engineering has an enclosed hydraulics laboratory facility which comprises of mainly the following:

- A space of 30 m by 50 m which could be used for hydraulic experiments including three dimensional model studies. The space is serviced by overhead moving measuring bridges and a gantry crane.
- Four narrow glass wall flumes (two flumes of 1.5 m deep by 0.6 m wide by 22 m long and two flumes of 1.2 m deep by 1.0 m wide by 40 m long) in which flow experiments can be performed. One of the 1.0 m wide flumes is also equipped with wave generator.
- One wide tilting glass wall flume (0.6 m deep by 2.0 m wide by 12 m long) for flow experiments.
- One large wave/current flume of 2 m wide by 2 m deep by 50 m long (30 m over which flow can be induced) with overhead gantry crane.
- Six supply pumps (total capacity of approximately 700/s) with pipe and channel reticulation system and three constant head tanks.
- One 6 m wide wave generator for experiments in a wave basin with 0.3 m water depth.
- Measurement instrumentation (including flow and water level recorders).

This is the largest laboratory for river and dam engineering studies in South Africa in terms of floor space and pump capacity.

## C) Available Hydrodynamic Computer Models

- Hydrodynamic, sediment transport and diffusion
  - MIKE 11
  - MIKE 21C
  - DELFT3D
  - TELEMAC
- Hydrodynamic, sediment transport
  - CCHE2D
- Flood routing and scour at bridges
  - HECRAS
- Water Supply reticulation, Sewer reticulation, Storm water Systems
  - WATERCAD
  - SEWERCAD
  - STORMCAD
  - HAMMER (pressure transients in pipelines)
- Hydrology and Storm Water Management
  - PCSWMM 2002 (EPA Storm Water Model)
  - DCUH (Unit Hydrograph Program)
- Coastal Engineering
  - CRESSWIN (General Coastal Engineering design and coastal processes calculations)
  - ACES (Automated Coastal Engineering Systems)
  - STFATE (dilution calculations of dredger dumped material)
  - CEM (Computational interactive coastal engineering manual of VeriTech Inc)

## D) Hydraulic structure (River and Dam) Model Studies recently completed and current by IWE

**Maguga Dam, Swaziland (1998-1999)**

Scale 1:30

Design discharge 11000 m<sup>3</sup>/s

Labyrinth spillway with skijump



### **Berg River Dam, South Africa (2003-2005)**

Scale 1:40

Side channel spillway with splitters and ski jump

Outlet tower with environmental flood releases

Design of plunge pool scour

SEF =  $740 \text{ m}^3/\text{s}$



### **Berg River abstraction works (2003-2006)**

Scale 1:50

River diversion with sand trap and pumpstation

Diversion  $6 \text{ m}^3/\text{s}$  and design river flow  $1100 \text{ m}^3/\text{s}$



### **Gurara Dam water transfer outfall, Nigeria (2005/2006)**

Scale 1:20

Baffle energy dissipater and drop energy dissipation



### **Ourkiss Dam, Algeria**

Scale 1:40

Side channel spillway with bend in chute, and ski-jump

Design flow  $250 \text{ m}^3/\text{s}$



### **Lower Usuthu Scheme (LUSIP) (2006)**

Three models with scales 1:15 to 1:50

Dam spillway  $2900 \text{ m}^3/\text{s}$

River abstraction works for irrigation  $10000 \text{ m}^3/\text{s}$

Irrigation offtake at dam  $15 \text{ m}^3/\text{s}$

### **Indonesia Hydropower intake (2004 to 2005)**

Three models at scales 1:20 to 1:40

Head pond

Canal intake to limit energy losses

Canal bend

Design flow  $170 \text{ m}^3/\text{s}$



### **Malaysia, Tanjung seawater intake and outfall (2004/2005)**

Two models of intake and outfall at 1:40

Intake basin for sedimentation and 103 m<sup>3</sup>/s pumpstation

Outfall culvert, energy dissipation with stilling basin and erosion protection



### **Vaal Dam pumpstation, South Africa (2005)**

Scale 1:50

Reservoir basin with sedimentation analysis

Reservoir flow  $4000 \text{ m}^3/\text{s}$  and pump capacity  $6 \text{ m}^3/\text{s}$



### **Ash River Dam, South Africa (2000)**

Scale 1:50

Stepped spillway energy dissipation with outlets for flow control

Balancing dam for tunnel flow

Flow =  $200 \text{ m}^3/\text{s}$

### **Rawsonville town flood management plan (2005)**

Distorted scale

Design of flood embankments at Rawsonville to protect existing developments: houses, road and bridges, during major floods.

Flood  $2000 \text{ m}^3/\text{s}$



### **Mfolozi flood diversion scheme (2004)**

Distorted scale model

1000 m flood diversion weir on floodplain and bifurcation to limit flooding of farmland



## Mhlathuze weir & pumpstation, South Africa (2003)

Scale 1:30

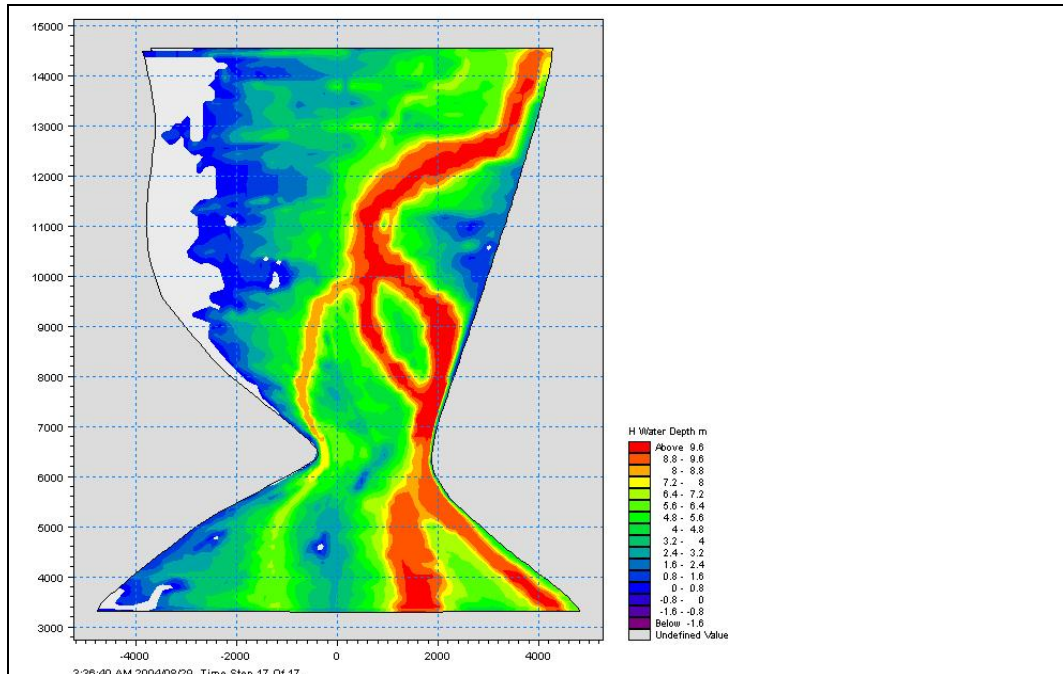
Rehabilitation & hydraulic redesign of weir with roller bucket due to scour downstream

Design flow 3000 m<sup>3</sup>/s

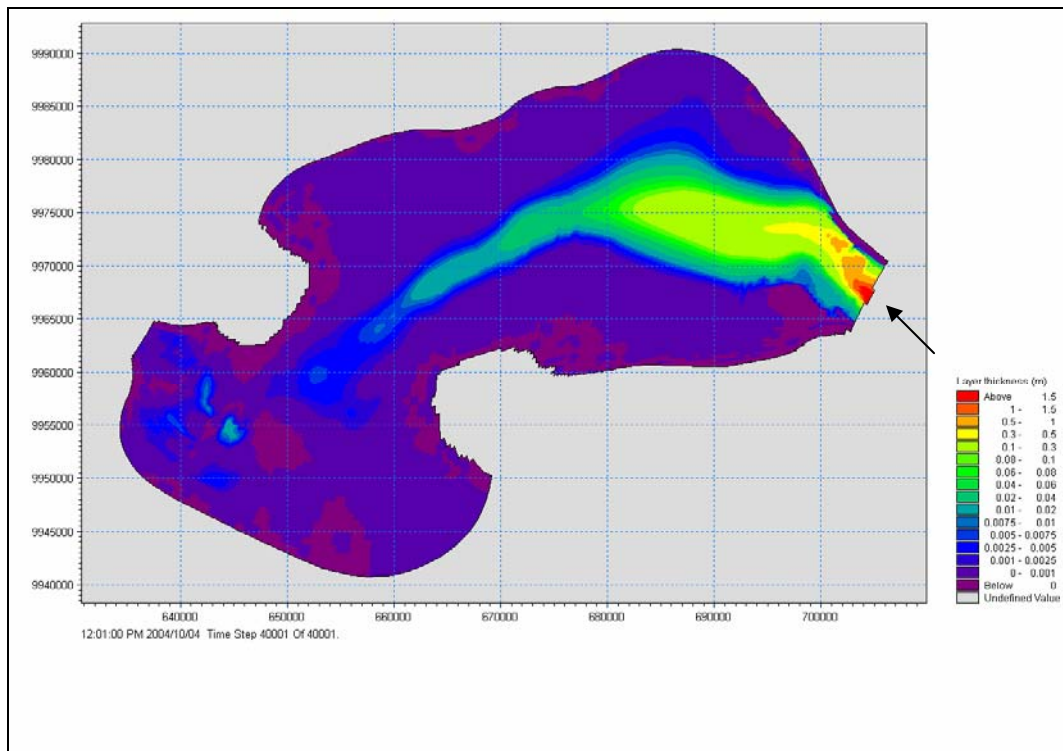


## E) Mathematical Modelling

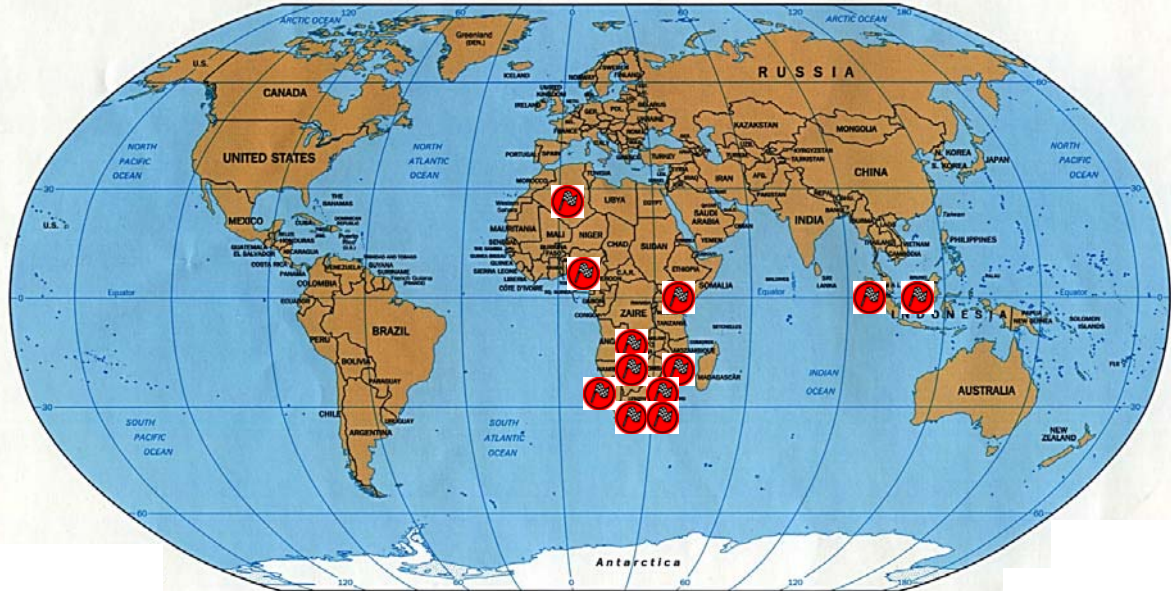
Many of the physical model studies are carried out in conjunction with 1D, 2D or 3D mathematical modelling, which often provide the boundary conditions for the physical models. In the figure below simulated flow depths in the **Zambezi River** at a proposed bridge site are shown during a major flood of 25000 m<sup>3</sup>/s



**Lake Victoria Sedimentation study** was carried out during 2005, Kenya. The figure below shows the simulated sediment deposition in Winam Gulf over a period of 50 years.



## F) Location of recent projects



Legend:  IWE project country